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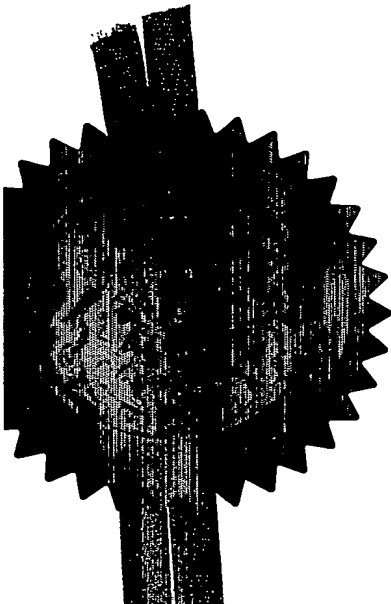
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P01/7700 0.00-0205974.9

Patent application number

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0205974.9

Full name, address and postcode of the or of each applicant (underline all surnames)

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THE NETHERLANDS

Patents ADP Number (if you know it)

7419294 001

If the applicant is a corporate body, give the country/state of its incorporation

THE NETHERLANDS

Title of the invention

AUTOMATIC DISCOVERING OF WEB SERVICES

Name of your agent (if you have one)

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

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7133 473 002

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(R. Turner)

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DESCRIPTION

AUTOMATIC DISCOVERING OF WEB SERVICES

5 This invention relates to a method for automatically discovering web services from a networked CE (consumer electronics) device using UDDI (Universal Description, Discovery and Integration).

 The term "web service" refers to the use of an Internet server to provide useful functionality or data to a remote client. By utilising standard protocols
10 (often SOAP, XML and HTTP) it is possible for a large range of devices (PCs, PDAs, mobile phones, etc.) to utilise these services. More importantly, these protocols allow software to automatically exploit the service without the need for human interaction, unlike a web site. Some web services will be particularly useful to consumer electronics devices, for example:

15 • A grocery shopping web service that allows a device to order items automatically. This could be used by a fridge, for example.

 • A music web service that provides enhanced information on artists, recordings and concerts. A CD or MP3 player could use this.

 • A TV schedules web service that provides data on programmes and
20 when they are broadcast. A Personal Digital Recorder or Integrated Digital TV would use this service.

1. State of the art

25 For more capable networked devices (PCs, PDAs) a number of user driven means already exist for finding new services:

 • The user manually enters the URL of the service. This is inconvenient, error prone and tends to favour the technically minded user. It also requires the device to have a means of text input.

30 • A search engine finds these services. This requires all services to be able to indicate compliance to a certain web service interface, and therefore requires the search engine to be modified in such a way that it can identify this

compliance. It also requires a protocol to be defined for allowing the device to retrieve the found services from the search engine.

- The device has its software or data cache upgraded over the network. Such a solution requires the manufacturer or some third party to provide a service for tracking new compliant web services and then sending the new software to the device. Such upgrades are not always feasible in a cheap embedded device.

It can be seen that this invention is particularly useful in lightweight CE devices that will often not be able to use any of the above three solutions.

2. The problem

Consider a CE device, which is able to use one or more web services to provide enhanced functionality and data to the user. It will be necessary for all the web service that the device uses to have a well-defined interface, which is supported and understood by the client device. At the point of sale the device will be pre-programmed with the location (i.e. URL) of a number of these services, which the device makes use of both automatically and as a result of user interaction. After this time it is likely that other businesses will provide new and enhanced, yet technically compatible, web services. The device has no systematic way of discovering these services and offering them to the user.

Up until now web based services have been predominantly HTML based and user driven. Standards to allow computer programs to communicate without user intervention have existed for a long time (e.g. Distributed COM) but these have not been suitable for small devices. It is only with the advent of IP/HTTP and the recent development of XML that the use of completely platform independent web services, which can be realistically used by lightweight CE devices has become feasible. Addressing the issue of discovering such services in a non-proprietary fashion is even more recent and has been the goal of the Universal Description, Discovery and Integration project. However, this work has been targeted at e-commerce and

business-to-business transactions. The specific needs of CE devices have not been considered.

3. What is proposed

5

This invention proposes a method for how such devices can automatically find new and compatible services, as they become available. The novel aspect is that it does this in a fully automatic fashion, which requires no intervention from the user. In this way, the device is able to offer the user a greater choice of services as they become available after the user bought the device. For example, in the case of a fridge, if a new store opened nearby which provides a grocery ordering web service, it would be possible for the device to alert the user of this fact, and also to be sure of the technical compliance of that service.

15

UDDI makes available structured information on registered web services via a well-defined interface, in a well-known location. When a service provider (i.e. the shop or the TV schedule listing provider) offer a new service they publish the details on a UDDI node and register it as being compliant with a particular web service standard (such as TV Anytime for TV schedules). This standard will have a unique identity (tModel) in the UDDI registry. When a CE device then queries the UDDI node it uses this unique identity to find compliant services. It is further proposed that the device can exploit other registered categorisation taxonomies to refine the search for services. For example, ISO 3166 is a global geographic classification taxonomy that a device could use to make sure that a shopping service was being offered by a shop in reasonable geographic proximity. Alternatively, by registering a genre taxonomy it would be possible to search for TV Anytime web services that specialise in movie information, say.

25

The following steps are required for implementation of the method:

30

1. A standards body (or similar initiative) standardises a web service interface suitable for a class of CE devices.

2. This service is registered with a UDDI node and is assigned a UUID (universally unique identifier) for that standard interface (using the UDDI save_tModel API).

3. Service providers produce implementations of this standard interface.

5 They register the new service using the save_service API, assuming that the business itself has already been registered with UDDI. The enclosed bindingTemplate will contain a reference to the UUID of the tModel registered in 2. At this stage they may also assign further standardised categorisations to their service (e.g. a retail service registers that it is based in London and offers
10 pet food.). The categorisations are added using the categoryBag sub-element of the businessService element.

4. A CE device is designed which is able to use the standardised web interface.

5. After being sold, the device queries a UDDI node to find services
15 which support this interface. To do this the find_business API is used containing just a tModelBag argument with a reference to the required tModel. A list of services is returned to the device, which can then be further refined automatically (based on machine-readable service descriptions) or by the user (based on brand preferences, recommendations, etc.).

20 6. Depending on the service type it is possible that the device can target its service discovery in an improved fashion. E.g. only find shops which are nearby, only find TV listing services for channels which the set top box is capable of showing, etc.

According to a first aspect of the present invention, there is provided a
25 method for automatically discovering web services comprising querying a known UDDI server address containing a list of web services, identifying from said list suitable web services, and automatically downloading at least one machine readable description of a web service.

According to a second aspect of the present invention, there is provided
30 apparatus for automatically discovering web services comprising processing means and communicating means arranged to carry out the above method.

The main advantage of such an approach is that it doesn't require user browsing or keyboard input. This makes it particularly appropriate for lightweight embedded CE devices that will generally not have technical users.

5 The suitable web services are those that the querying device can use to enhance its functionality. The identifying stage is based upon the structure of the defining protocol that categorises the web services. In this way all devices can use the same methodology for obtaining web services, with only those appropriate to the requesting device being returned. Web services can be easily added and devices already installed can periodically query the address
10 to obtain new services.

4. Fields of application of the invention

In general the invention could be exploited by any network enabled CE
15 device which makes use of a web-service that is based on an open standard. Some obvious examples have already been given. Other uses are:

- Digital Audio Broadcast receiver could obtain improved programme listings.
- An oven or microwave that can exploit a standard "recipe finder" web
20 service.
- Any device could use a web service to indicate that it has a fault or requires servicing and needs to call out a technician.

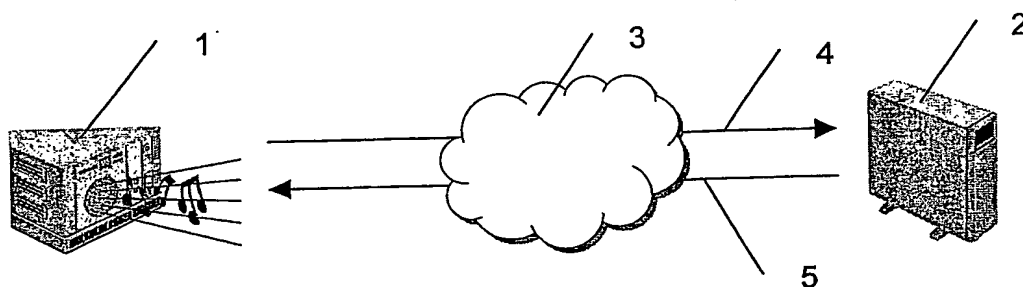
5. An example of the invention

25

Figure 1 illustrates a conventional operation of a network-enabled, embedded device, and Figure 2 illustrates the enhanced operation of a network-enabled, embedded device, as an example of the invention.

1. / 2

Conventional operation of a network-enabled, embedded device

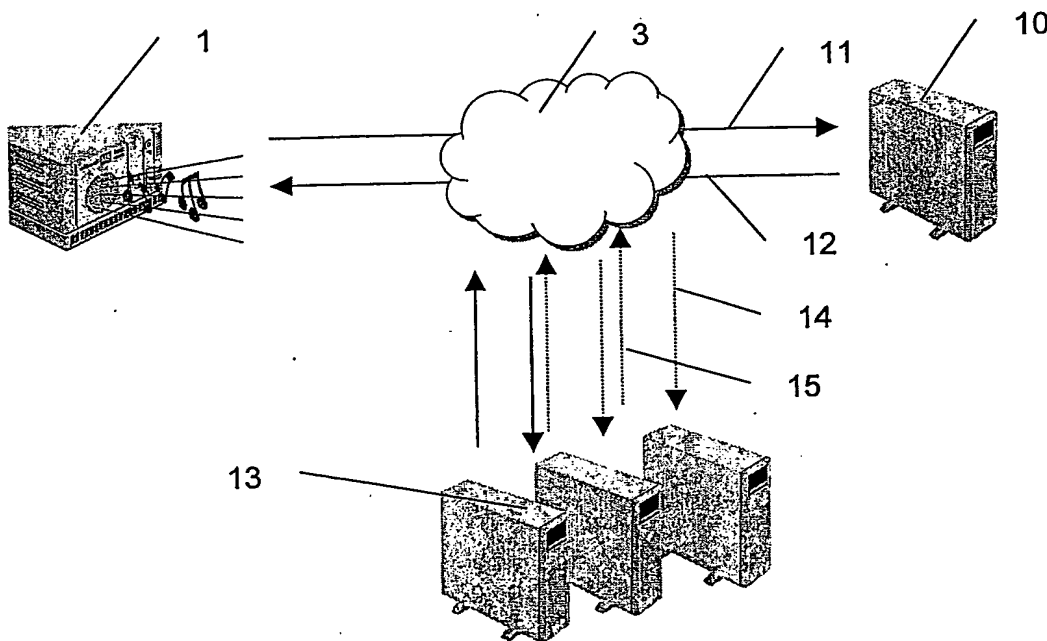


1. Network enabled embedded device (such as a Digital Audio Broadcast receiver).
2. Remote network server, offering a related web service (such as track listings, information on artists, etc.).
3. A wide area network (such as the Internet).
4. A structured query from 1 to 2 (such as a SOAP request for information on a particular song).
5. A structured response from 2 to 1 (such as a SOAP response containing the information on a particular song).

Fig 1

2/2

Enhanced operation of a network-enabled, embedded device



- 10. A UDDI server (at a well-known URL).
- 11. A structured UDDI query from 1 to 10 (such as a request for web services which are technically compliant with 2 and offer information for radio broadcasts within the UK).
- 12. A structured UDDI response from 10 to 1 (such as a response containing the information on those services which satisfy the criteria of 11).
- 13. One or more new-found web service. These web services are distinct, may have been set up after the device 1 was sold, and are all technically compliant with 2 (i.e. they can be successfully used by device 1).
- 14. A structured query from 1 to 13.
- 15. A structured response from 13 to 1.

Fig 2

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